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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/790,567	03/01/2004	Christopher F. Lyons	03-05	9875
22443	7590	11/18/2005		
LAW OFFICE OF MONICA H CHOI P O BOX 3424 DUBLIN, OH 430160204			EXAMINER NOVACEK, CHRISTY L	
			ART UNIT 2822	PAPER NUMBER

DATE MAILED: 11/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/790,567	Applicant(s) LYONS ET AL.	
	Examiner Christy L. Novacek	Art Unit 2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 October 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) 14-25 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This office action is in response to the election filed October 7, 2005.

Election/Restrictions

Applicant's election of the invention of Group I, claims 1-13 in the paper filed October 7, 2005 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claims 14-25 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim.

Election was made **without** traverse in the reply filed on October 7, 2005.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 13 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The next to last line of claim 13 recites the limitation of "the IC material". There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-6 and 8-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pike et al. (US 6,420,097) in view of Yin et al. (US 6,936,539).

Regarding claim 1, Pike discloses forming an organic under-layer (118) over IC material (116), patterning the organic under-layer to form an organic mask structure (126), and trimming the organic mask structure to lower a critical dimension of the organic mask structure (Fig. 3-4f; col. 3, ln. 61 – col. 5, ln. 8). Pike does not disclose that the organic under-layer is rigid, but Pike also does not disclose that the organic under-layer is deformed. Like Pike, Yin discloses a process of using an organic under-layer as an antireflective coating (ARC) for patterning IC material. Yin teaches that it is beneficial to use an ARC of amorphous carbon because the amorphous carbon offers the advantages of superior etch selectivity and the ability to be removed in the same process that is used to remove the overlying photo-resist (col. 2, ln. 45-65). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the ARC of Yin for the BARC of Pike because Pike discloses that the BARC can be an organic layer and Yin teaches an organic ARC that has the advantages of superior etch selectivity and the ability to be removed in the same process that is used to remove the overlying photo-resist. Like Applicant's organic under-layer, the organic under-layer of Yin is formed of carbon that is deposited using propylene in a CVD process (col. 4, ln. 12-59). Therefore, it appears that the organic under-layer of Yin would inherently possess the function of being rigid. See *In re Swinehart*, 439 F.2d 210, 212-13, 169 USPQ 226, 229 (CCPA 1971) "where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in

the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that the subject matter shown to be in the prior art does not possess the characteristics relied on"); and *In re Fitzgerald*, 619 F.2d 67, 205 USPQ 594 (CCPA 1980) (a case indicating that the burden of proof can be shifted to the applicant to show that the subject matter of the prior art does not possess the characteristic relied on whether the rejection is based on inherency under 35 U.S.C. 102 or obviousness under 35 U.S.C. 103).

Regarding claim 2, Pike discloses etching away any portion of the IC material that is not under the organic mask (Fig. 4e-4f; col. 4, ln. 30-42).

Regarding claim 3, Pike discloses that the step of patterning the organic under-layer involves forming a layer of photo-resist on the organic under-layer, patterning the photo-resist in a photolithography process, and etching away any portion of the organic under-layer not under the photo-resist (col. 4, ln. 14-29; col. 5, ln. 1-8).

Regarding claims 4 and 5, Pike discloses that the step of removing the photo-resist after the trimming is optional (col. 4, ln. 30).

Regarding claim 6, Pike and Yin disclose that the organic under-layer is used in the photolithography process to act as a BARC during patterning of the photo-resist. Neither Pike nor Yin specifically discloses that the organic under-layer is opaque to light. However, like Applicant's organic under-layer, the organic under-layer of Yin is formed of carbon that is deposited using propylene in a CVD process (col. 4, ln. 12-59). Therefore, it appears that the organic under-layer of Yin would inherently possess the function of being rigid. See *In re Swinehart*, 439 F.2d 210, 212-13, 169 USPQ 226, 229 (CCPA 1971) "where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in

the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that the subject matter shown to be in the prior art does not possess the characteristics relied on"); and *In re Fitzgerald*, 619 F.2d 67, 205 USPQ 594 (CCPA 1980) (a case indicating that the burden of proof can be shifted to the applicant to show that the subject matter of the prior art does not possess the characteristic relied on whether the rejection is based on inherency under 35 U.S.C. 102 or obviousness under 35 U.S.C. 103).

Regarding claim 8, Pike discloses that a hard-mask layer can be formed between the IC material and the organic under-layer, etching away any portion of the hard-mask layer not under the rigid organic mask structure and etching away any portion of the IC material not under the hard-mask structure (col. 4, ln. 59-67).

Regarding claims 9 and 10, Pike discloses leaving the organic under-layer on the substrate until after the gate is etched, but Pike doesn't disclose any process steps after the gate is etched. At the time of the invention, it would have been obvious to one of ordinary skill in the art to leave the organic under-layer on the hard mask in the event that the organic under-layer provides a structural and/or electrical benefit to the semiconductor device being formed or to remove the organic under-layer in the event that the organic under-layer does not provide a structural or electrical benefit to the semiconductor device.

Regarding claim 11, Yin discloses that the rigid organic under-layer is a carbon film that is formed by using propylene in a CVD process (col. 4, ln. 12-59).

Regarding claim 12, Pike does not disclose the width of the organic under-layer mask after it has been trimmed. At the time of the invention, it would have been obvious to one of ordinary skill in the art to use routine experimentation to determine an optimal width of the

trimmed organic under-layer mask of Pike, depending upon the width of the gate desired because such variables of art recognized importance are subject to routine experimentation and discovery of an optimum value for such variables is obvious. See *In re Aller*, 105 USPQ 233 (CCPA 1955).

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pike et al. (US 6,420,097) in view of Yin et al. (US 6,936,539) as applied to claim 3 above, and further in view of Yin et al. (US 6,939,794).

Regarding claim 7, neither Pike nor Yin ('539) discloses that the organic under-layer is transparent. Like Yin ('539), Yin ('794) discloses forming an amorphous boron-doped carbon layer that is used as a mask for etching. Yin ('794) teaches that this organic mask layer can be made more transparent by altering the deposition process of the layer. Yin ('794) discloses that it is advantageous to make the organic mask layer more transparent in order that alignment marks on the wafer can be visibly seen through the mask layer (col. 6, ln. 33-55). At the time of the invention, it would have been obvious to one of ordinary skill in the art to deposit the organic under-layer of Yin ('539) such that it is transparent because Yin ('794) teaches that an amorphous boron-doped carbon mask layer can be made more transparent so that alignment marks on the wafer can be seen through the mask.

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pike et al. (US 6,420,097) in view of Yin et al. (US 6,936,539) and Adetutu et al. (US 6,933,227).

Regarding claim 13, Pike discloses depositing a polysilicon layer (116) with a thickness of 500-5000 Å on a semiconductor substrate, depositing a hard-mask layer with a thickness of

50-500 Å on the polysilicon layer, depositing an organic under-layer (118) on the hard-mask layer, depositing a photo-resist layer with a thickness of less than 2500 Å on the organic under-layer, patterning the photo-resist in a photolithography process to form a photo-resist mask structure, wherein the organic under-layer is used in the photolithography process to act as a BARC during patterning of the photo-resist, etching away any portion of the organic under-layer not under the photo-resist mask structure to form an organic mask structure (126), trimming the organic mask structure to lower a critical dimension of the organic mask structure, wherein the photo-resist is completely stripped away from the top of the organic mask structure after the trimming step, etching away any portion of the hard-mask layer not under the rigid organic mask structure, wherein the organic under-layer remains on top of the hard-mask structure, and etching away any portion of the polysilicon (IC) material not under the hard-mask structure to form a polysilicon (IC) structure having the critical dimension of the organic mask structure (Fig. 3-4f; col. 3, ln. 61 – col. 5, ln. 8). Pike does not disclose that the organic under-layer is rigid, but Pike also does not disclose that the organic under-layer is deformed. Like Pike, Yin discloses a process of using an organic under-layer as an antireflective coating (ARC) for patterning IC material. Yin teaches that it is beneficial to use an ARC of amorphous carbon because the amorphous carbon offers the advantages of superior etch selectivity and the ability to be removed in the same process that is used to remove the overlying photo-resist (col. 2, ln. 45-65). At the time of the invention, it would have been obvious to one of ordinary skill in the art to use the ARC of Yin for the BARC of Pike because Pike discloses that the BARC can be an organic layer and Yin teaches an organic ARC that has the advantages of superior etch selectivity and the ability to be removed in the same process that is used to remove the overlying photo-resist.

Neither Pike nor Yin specifically discloses that the organic under-layer is opaque to light. However, like Applicant's organic under-layer, the organic under-layer of Yin is formed of carbon that is deposited using propylene in a CVD process (col. 4, ln. 12-59). Therefore, it appears that the organic under-layer of Yin would inherently possess the function of being rigid and opaque. See *In re Swinehart*, 439 F.2d 210, 212-13, 169 USPQ 226, 229 (CCPA 1971) "where the Patent Office has reason to believe that a functional limitation asserted to be critical for establishing novelty in the claimed subject matter may, in fact, be an inherent characteristic of the prior art, it possesses the authority to require the applicant to prove that the subject matter shown to be in the prior art does not possess the characteristics relied on "); and *In re Fitzgerald*, 619 F.2d 67, 205 USPQ 594 (CCPA 1980) (a case indicating that the burden of proof can be shifted to the applicant to show that the subject matter of the prior art does not possess the characteristic relied on whether the rejection is based on inherency under 35 U.S.C. 102 or obviousness under 35 U.S.C. 103).

Pike does not disclose the width of the organic under-layer mask after it has been trimmed. At the time of the invention, it would have been obvious to one of ordinary skill in the art to use routine experimentation to determine an optimal width of the trimmed organic under-layer mask of Pike, depending upon the width of the gate desired because such variables of art recognized importance are subject to routine experimentation and discovery of an optimum value for such variables is obvious. See *In re Aller*, 105 USPQ 233 (CCPA 1955).

Pike discloses forming a hard-mask layer between the polysilicon layer and the organic under-layer but does not disclose that the hard-mask is silicon nitride. Pike does not disclose the thickness of the hard-mask layer. Like Pike, Adetutu discloses a process of etching a gate

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electrode using an organic ARC layer and a hard-mask layer underneath the ARC layer. Adetutu teaches that it is beneficial to form the hard-mask layer of a material such as silicon nitride having a thickness of 20-500 Å because this type of hard-mask can prevent oxidation of its underlying layers (col. 2, ln. 45-56). At the time of the invention, it would have been obvious to one of ordinary skill in the art to form the hard-mask of Pike as taught by Adetutu because Adetutu teaches that this type of hard-mask can successfully prevent oxidation of its underlying layers.

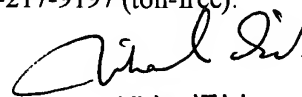
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christy L. Novacek whose telephone number is (571) 272-1839. The examiner can normally be reached on Monday-Thursday and alternate Fridays 7:30 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

CLN
November 10, 2005


Michael Trinh
Primary Examiner